

3) The scales are all more or less uniform, except the rows bordering the ventrals which are slightly larger in size. They are prominently leaflike in appearance with a clear keel, which becomes less and less conspicuous towards the flanks till it is almost absent in the last rows bordering the ventrals.

4) The scales are so closely arranged that they are almost overlapping one another, with no interspaces between them.

5) The ventral plates are very large and forms almost one-third to half the width of the skin.

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K. VISWANATHAN

16. FOOD OF *RANA HEXADACTYLA* LESSON

A fair amount of literature is available on the diet of the Indian Bull Frog, *Rana tigerina* (Mullan 1912; Ishwar Prakash 1953; Wadekar 1963; Joshee 1968; Isaac and Rege 1975) but little is known about the food of *Rana hexadactyla*. The present study was undertaken with the object of determining the food of *Rana hexadactyla* by the examination of the stomach contents.

MATERIALS AND METHODS

The frogs were collected between February and September of 1975 from paddy fields, rivers and ponds. They were captured at night, killed immediately and preserved in 10 per cent formalin. In the laboratory, the frogs were weighed, sexed and dissected out to collect the stomach contents. The weight of stomach contents of each frog was recorded and the different food items from individual stomachs were identified. Out of the 319 frogs dissected for stomach contents 203 were females and 116 males. Frogs with their stomach contents weighed between 25 gm and 100 gm.

RESULTS AND DISCUSSION

Table 1, which gives the different food items of *Rana hexadactyla*, indicates that insects form the main diet. From the observations recorded in the present study it can be noticed that insects, crabs, snails, small fishes and young frogs are the major food items. Arthropods form the bulk of the diet of *R. hexadactyla*. Amongst the arthropods insects appear to be most favoured food of this frog. Some of these insects are of great economic importance. A few centipedes and millipedes and quite a number of arachnids were also recorded from the stomachs of this animal.

Crabs were found in large numbers in the diet of *R. hexadactyla*. They are often seen in the paddy fields and cause damage to the bunds in the fields by boring holes in them. Crabs are recorded as one of the major pests of paddy (Kadam *et al.* 1960) and are known at some stages of their life to feed on rice seedlings both before and after transplanting. The frog is thus very helpful in keeping the population of crabs harmful to agriculture in

TABLE 1

ANALYSIS OF THE STOMACH CONTENTS OF *Rana hexadactyla* LESSON

Classified food items	Number of individual food items collected	Number of stomachs from which collected	Remarks
Phylum ARTHROPODA			
Class INSECTA			
Order ODONATA			
Dragonfly	5	5	broken into pieces
Nymph of Dragon fly	1	1	predaceous in habit.
Order DERMAPTERA			
Family Labiduridae			
<i>Labidura riparia</i>	3	3	carnivorous, eats small insects.
Order ORTHOPTERA			
Family Gryllotalpidae			
<i>Gryllotalpa fossor</i>	6	6	pest on paddy.
Family Gryllidae			
<i>Gymnogryllus</i> sp.	1	1	
<i>Gryllus</i> sp.	1	1	omnivorous.
Family Acrididae			
<i>Spathosternum caliginosum</i> W.	1	1	
<i>Hieroglyphus banian</i>	3	3	very harmful to paddy.
Order HEMIPTERA			
Family Belostomatidae			
<i>Sphaerodema rusticum</i>	11	11	carnivorous water bugs.
FAMILY Gerridae			
<i>Gerris</i> sp.	23	1	water skaters.
Order LEPIDOPTERA			
Caterpillar	49	32	great economic importance.*
Order DIPTERA			
Family Culicidae			
<i>Anopheles</i> sp.	1	1	transmits malaria.*
Family Chironomidae			
Chironomus larva	2	1	
Family Muscidae			
<i>Musca</i> sp.	1	1	household pest.
Order HYMENOPTERA			
Family Formicidae			
<i>Diacamma vagans</i> Smith	7	7	
<i>Odontomachus</i> sp.	5	5	
Order COLEOPTERA			
Family Carabidae			
<i>Bembidion soborium</i> ..	8	3	highly predaceous.
<i>Chlaenius</i> sp.	7	4	
<i>Dioryche</i> sp.	2	2	

MISCELLANEOUS NOTES

Family Scarabaeidae			
<i>Anomala dussumieri</i>	4	1	larva forms damage roots of paddy & cereals.
<i>Autoserica insanabilis</i> Brenske	7	2	
<i>Anserica</i> sp.	4	2	
<i>Mimela</i> sp.	2	1	
Family Hydrophilidae			
<i>Sternolophus brachyacanthus</i> Reg.	12	5	
<i>Hydrophilid</i> sp.	1	1	larvae predaceous.
Family Elateridae			
<i>Melanotus hirticornis</i>	4	3	
Family Tenebrionidae			
<i>Gonocephalum</i> sp.	2	1	
Family Curculionidae			
<i>Odioporus</i> sp.	1	1	
Class CRUSTACEA			common in paddy fields and pest of crops; some in semi-digested condition.
<i>Paratelphusa (Oziotelphusa) bouvieri</i> Rathteum	13	10	
Class ARACHNIDA			
Order ARANIDA			
Family Lycosidae			
<i>Pardosa songosa</i> Tikader & Malhotra	1	1	
<i>Pardosa burasantiensis</i> Tikader & Malhotra	1	1	
<i>Lycosa sumatrana</i> Thorell	2	2	
<i>Lycosa bistrriata</i> (Gravely)	1	1	
Family Araneida			
<i>Araneus</i> sp.	5	2	
Family Heteropodidae			
<i>Heteropoda</i> sp.	1	1	
Family Tetragnathidae			
<i>Tetragnatha mandibulata</i>	1	1	
Class MYRIAPODA			
Order SCOLOPENDROMORPHA			
Family Scolopendridae			
<i>Otostigmus</i> sp.	3	3	
Millipede	2	1	broken into pieces.
Phylum MOLLUSCA			
Class GASTROPODA			
Order BASOMMATOPHORA			
Family Planorbidae			
<i>Indoplanorbis exustus</i> (Deshayes)	10	2	Shells in undigested condition.
Order SYSTELLOMMATOPHORA			
Family Veronicellidae			
<i>Laevicaulis</i> sp.	1	1	

Class PISCES			
Order CYPRINOIDEA			
Family Cyprinidae			
<i>Puntius sophore</i> (Ham.)	10	6	few semidigested.
Family Naudidae			
<i>Badis badis</i> (Ham.)	6	2	semidigested.
<i>Anabas scondens</i>	1	1	semidigested.
Class AMPHIBIA			
Order ANURA			
Family Ranidae			
<i>Rana</i> sp.	5	5	young frogs and semidigested; in few cases bones only.
Class REPTILIA			
Order OPHIDIA			
Family Typhlopidae			
<i>Typhlop</i> sp.	2	2	broken into pieces.
Snake	2	2	only tail and skin.

check. Some gastropods were recorded from the stomachs of a few specimens. The vertebrate groups such as Pisces, Amphibia and Reptilia were also represented in the food of this frog, but there is no reason to believe that they form regular items of the diet.

Vegetable matter in the form of leaves, grass blades, algae, etc. and gravel were seen in the stomachs of a number of frogs. It seems more likely that the vegetable matter as also the gravel is taken up by the animal accidentally along with food. The occurrence of gravel in the stomachs of frogs is reported by many workers.

Mondal (1970) observed that the "Northern race" of *R. hexadactyla* is phytophagous while in the "Southern race" the animal food was preferred and preponderates over vegetable matter. The present study indicates that *R. hexadactyla* in this area of Kerala is largely carnivorous, feeding on animal food only. It is possible that the vegetable material found in the stomachs of a number of frogs was taken in accidentally along with other food.

The examination of the intestine of tadpoles of *R. hexadactyla* shows that the vegetable

matter forms their main food. The highly coiled and elongated nature of the alimentary canal indicated their herbivorous food habit. Food of juvenile frogs consists largely of insects (Jameson and Rose 1956) and that of tadpoles mainly the different species of algae (Kamat 1962).

The present observations indicate that *R. hexadactyla* feeds on some important agricultural pests, especially paddy pests. Thus this species of frog plays a significant role in the economy of nature by controlling agricultural pests in the field.

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REFERENCES

- ISAAC, S. AND REGE, M. S. (1975): Food of *Rana tigerina* (Daud.) *J. Bombay nat. Hist. Soc.* 72 (1): 143-157.
- JAMESON, D. L. AND ROSE, M. M. (1956): Food habits in juvenile frogs. *Copeia* 1956 (4): 261.
- JOSHEE, A. K. (1968): Food habits of the Bull Frog (*Rana tigerina* Daud.). *J. Bombay nat. Hist. Soc.*, 65 (2): 498-500.
- KADAM, M. V. BHAT AND PATEL, G. A. (1960): 'Crop pests and how to fight them.' Dir. Pub. Govt. of Maharashtra, Bombay.
- KAMAT, N. D. (1962): On the intestinal contents of tadpoles and algae of small ponds. *Curr. Sci.*, 31: 300-301.
- MONDAL, A. K. (1970): On the distribution, occurrence, culture possibilities and food of *Rana hexadactyla* Lesson. *Scie. and Cult.*, 36: 138-143.
- MULLAN, J. P. (1912): The food of a Bull-frog (*Rana tigerina*). *J. Bombay nat. Hist. Soc.* 21 (4): 1341.
- PRAKASH, ISHWAR (1953): Addition to recorded food items of the Bull Frog (*Rana tigerina*). *J. Bombay nat. Hist. Soc.* 51 (3): 750.
- WADEKAR, U. L. (1963): The diet of the Indian Bull-frog (*Rana tigerina* Daud.). *J. Bombay nat. Hist. Soc.*, 60 (1) 263-268.

17. ON THE BREEDING BEHAVIOUR OF *SCHIZOTHORAX NIGER* HACKEL IN DAL LAKE¹

(With a text-figure and a photograph)

INTRODUCTION

The fishes of sub-family schizothoracinae of Dal lake are known to perform spawning migration and lay eggs on the bottom of snowed streams (Rampal 1967; Jan and Dass 1971; Sunder *et al.* 1977 and CIFRI Bull. 1977) that empty into the lake. During spring of 1977 spawning grounds of *Schizothorax niger* were located for the first time in the Dal lake itself, differing thus in breeding habits from other members of the sub-family. The eggs were located in the shallower regions of the lake around Bhatmazar (behind Engineering College), Gurtupora, Lathkadal on the south-east of lake and Sonalank in the Harzatbal-Saidakadal region (Fig. 1). Eggs were also collected in the shallow areas of Pishpow nal-

lah (Shalimar region) on the north-west of the lake. In Harzatbal-Saidakadal region the eggs were found attached to the submerged adventitious roots of willow (*Salix* spp) trees, while in the Shalimar region they were found scattered in clutches along the lake bed close to springs. The fertilized eggs ranged in diameter between 2.6-3.5 mm. The physico-chemical characteristics of the Harzatbal-Saidakadal and Shalimar-Thaksar regions of the lake are given below in Table 1.

The percentage of fertilization as determined by acetic acid method ranged between 75 to 84. Quantitative assessment of eggs attached to willow roots could not be made while number of eggs laid on lake bed ranged from 400 to 460 m², only 50 per cent of eggs were found viable. The spawning period was ob-